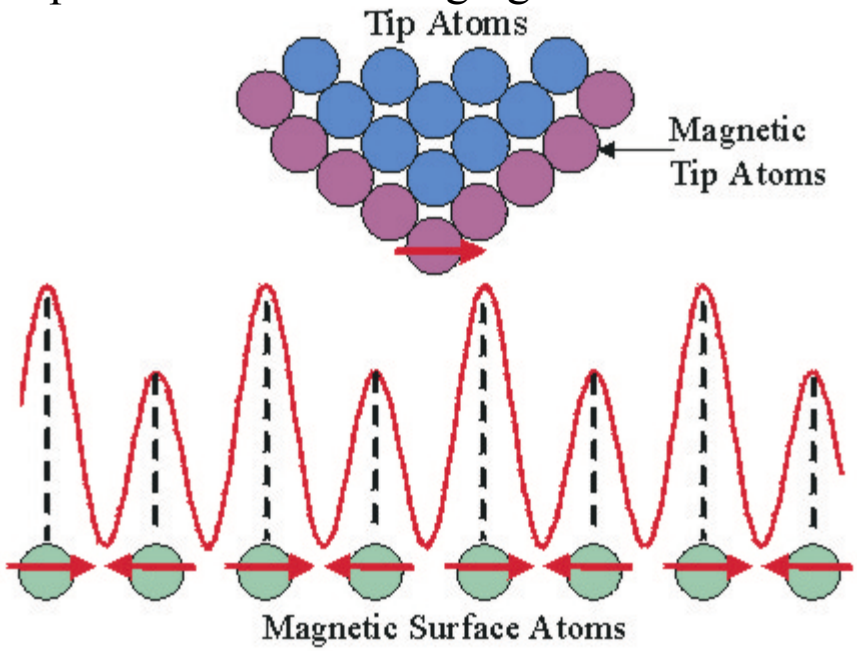
CAREER/PECASE: Growth and Analysis of Novel Nitride Semiconductor Systems

Arthur R. Smith, Ohio University, Athens, OH, DMR-9983816.

Spin-Polarization Imaging at the Atomic Scale



The above figure illustrates the principle of imaging spin at the atomic scale. A sharp needle-like probe coated with magnetic atoms images the surface. When probe and sample spins line up, the atoms appears brighter; when they are anti-parallel, the atoms appear less bright. Upper right image shows a surface as it appears without spin contrast; lower right image shows same surface area with spin contrast.

Manganese Nitride

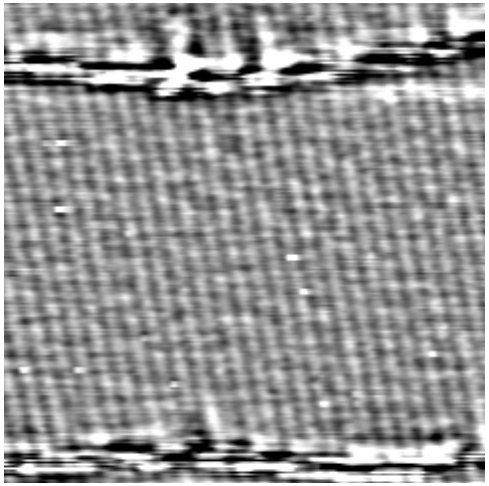


Image without spin polarization

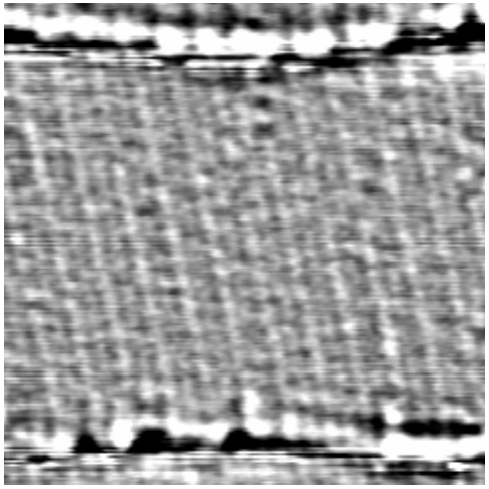


Image with spin polarization

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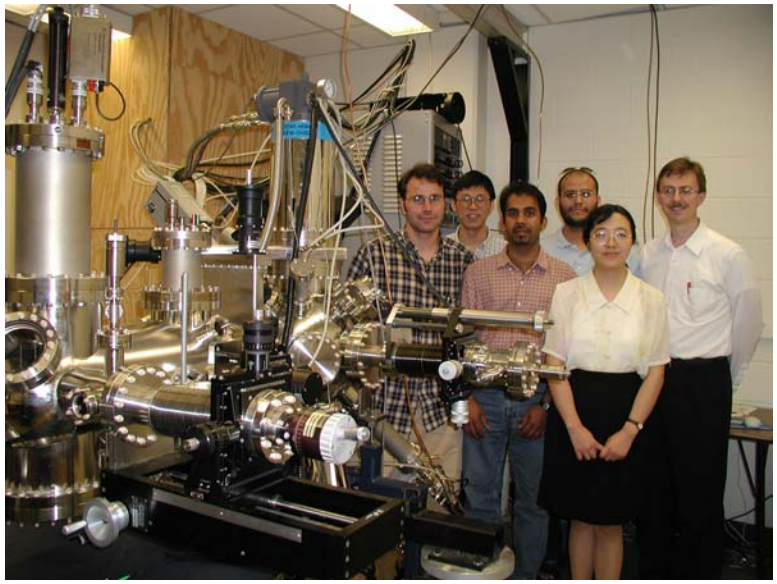
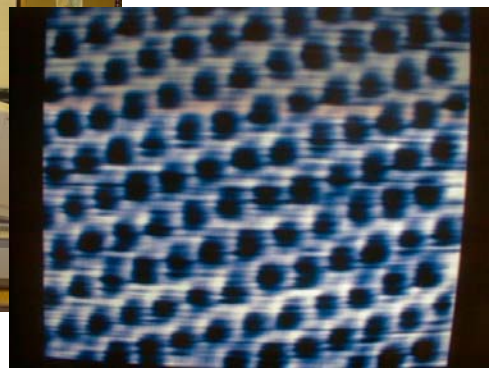
Education in electronic materials synthesis and analysis. Shown here are, from left to right, Costel Constantin (GA), Haiqiang Yang (former Postdoc), Muhammad Haider (GA), Hamad Al-Brithen (GA), Rong Yang (GA), and PI Art Smith. Students learn the use of molecular beam epitaxy to make ultra-thin films of exotic transition metal nitrides using the equipment shown, as well as characterization of films using techniques such as scanning tunneling microscopy (STM) and *spin-polarized* STM.



ATOMS Outreach Program
K-12 Teachers and Students in Southeastern Ohio are learning to use a scanning tunneling microscope to "see" individual atoms.

← Teachers teaching teachers

Students taking images →



honeycomb image of carbon atoms →

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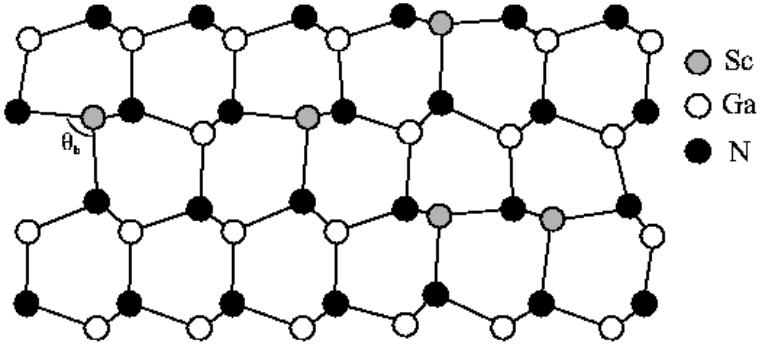
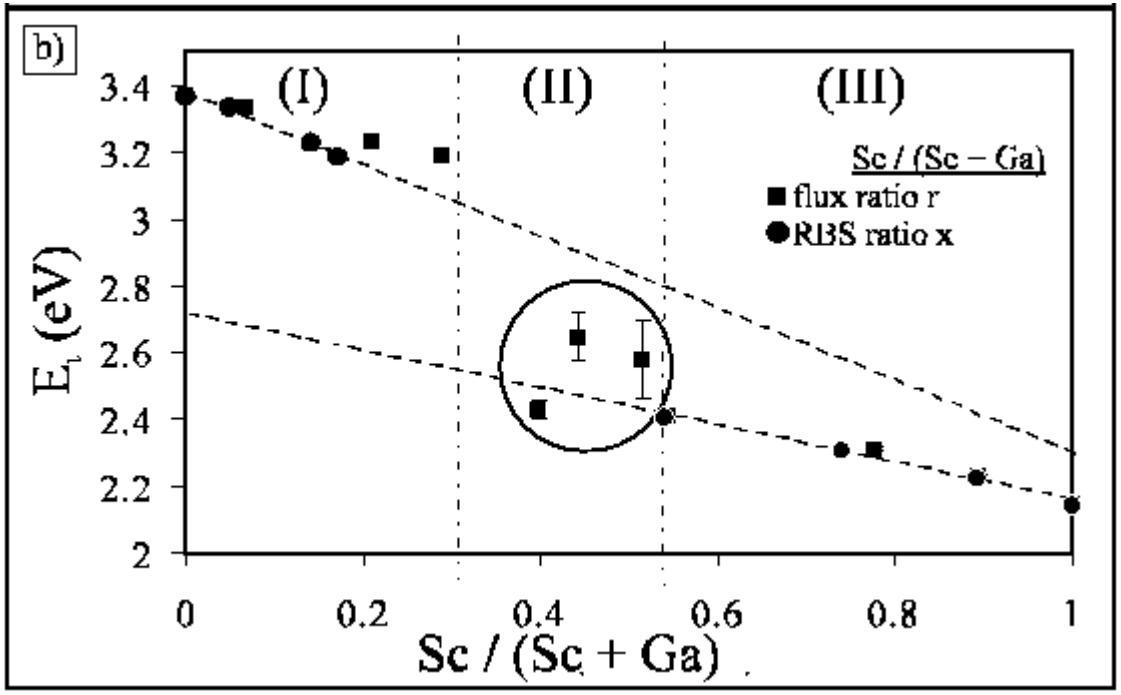
Investigation of ScGaN: a novel IIIB/IIIA Ternary Nitride Semiconductor

At right is presented a schematic model, based on experimental data, of ScGaN. Since ScN favors octohedral bonding, whereas GaN favors tetrahedral, a distorted structure is obtained at low Sc composition.





At left is shown the map of the direct optical transition for ScGaN as a function of the Sc fraction. Three regions are distinquished:

I. distorted wurtzite-like region
II. transitional region
III. rocksalt region

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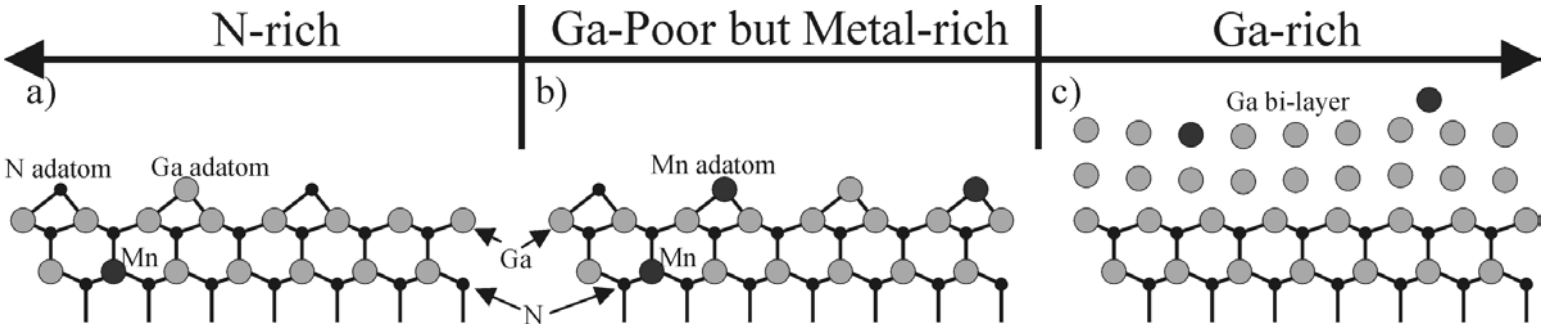
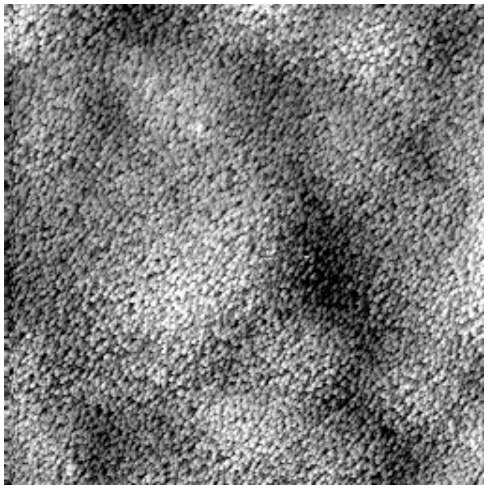
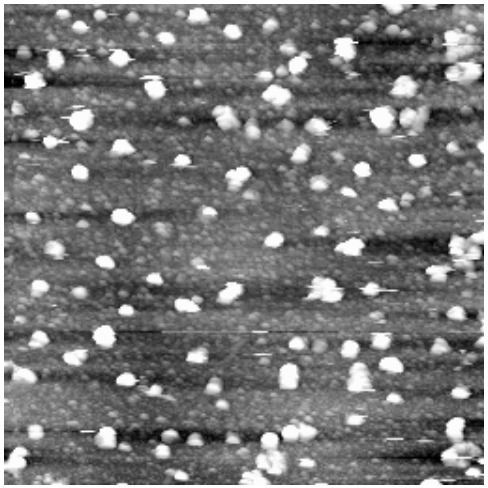
Growth of MnGaN Ternary Nitride Semiconductor: a Potential Spintronic Material

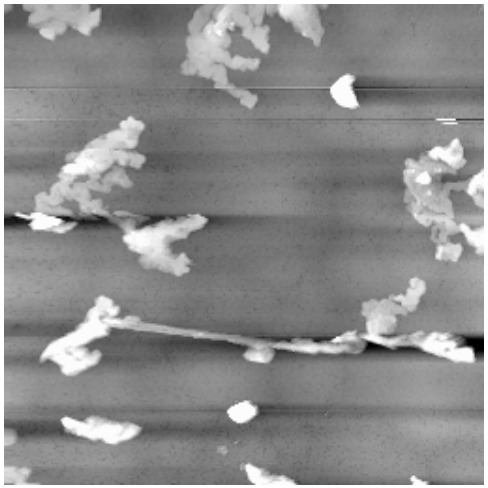




AFM image
40 μm x 40 μm



AFM image
20 μm x 20 μm



AFM image
40 μm x 40 μm